Differentiation of Polynomial Functions

Rule: If $y = ax^n$, then $y' = n \cdot ax^{n-1}$
If $y = ax$, then $y' = a$
If $y = a$, then $y' = 0$

Polynomial functions may include

- ***fractional indices (roots)***: square roots, cube roots etc must be written in index form before differentiating, e.g. $\sqrt[3]{x}$ written as $x^{1/3}$.
- ***negative indices***: terms such as $\frac{1}{x^5}$ need to be written as x^{-5}
- ***rational expressions***: rational expressions need to be simplified, if possible, before differentiating (e.g. $\frac{x^3+2x^2-7}{x} = x^2 + 2x - 7x^{-1}$)

Example: Differentiate these expressions.

1) $y = 2x + \frac{3}{x}$

$y' = 2 - 3x^{-2} = 2 - \frac{3}{x^2}$

2) $y = 4\sqrt{x} - x^2$

$y' = 2x^{-1/2} - 2x = \frac{2}{x^{1/2}} - 2x = \frac{2}{\sqrt{x}} - 2x$

3) $y = 3x^{2/3} - 4x^{1/3}$

$y' = 2x^{-1/3} - \frac{4}{3}x^{-2/3}$

4) $y = \frac{2}{\sqrt{x}} + x$

$y = \frac{2}{x^{\frac{1}{2}}} + x = 2x^{-\frac{1}{2}} + x$

$y' = -x^{-3/2} + 1$

5) $y = \frac{1}{2x^2} - \frac{1}{2x}$

$y = \frac{1}{2}x^{-2} - \frac{1}{2}x^{-1}$

$y' = -x^{-3} + \frac{1}{2}x^{-2} = \frac{-1}{x^3} + \frac{1}{2x^2}$

6) $y = \frac{5x^4+6x}{x^2}$

$y = \frac{5x^4}{x^2} + \frac{6x}{x^2} = 5x^2 + \frac{6}{x} = 5x^2 + 6x^{-1}$

$y' = 10x - 6x^{-2} = 10x - \frac{6}{x^2}$

Delta Ex 6.1 pg 82
Homework: Delta Ex 1.1 pg 2